TDM

TOPOGRAPHY AND DEFORMATION MEASUREMENT

The reliability of components and assemblies under realistic operation conditions is of crucial importance for the failure free operation of the assembly during its projected lifetime. Well before physical failures occur, the deformation characteristics of an assembly under temperature variations which are typical for those encountered under real operation conditions may allow a deep insight into potential failure modes and reliability risks. TDM is particularly well suited for such type of analysis :

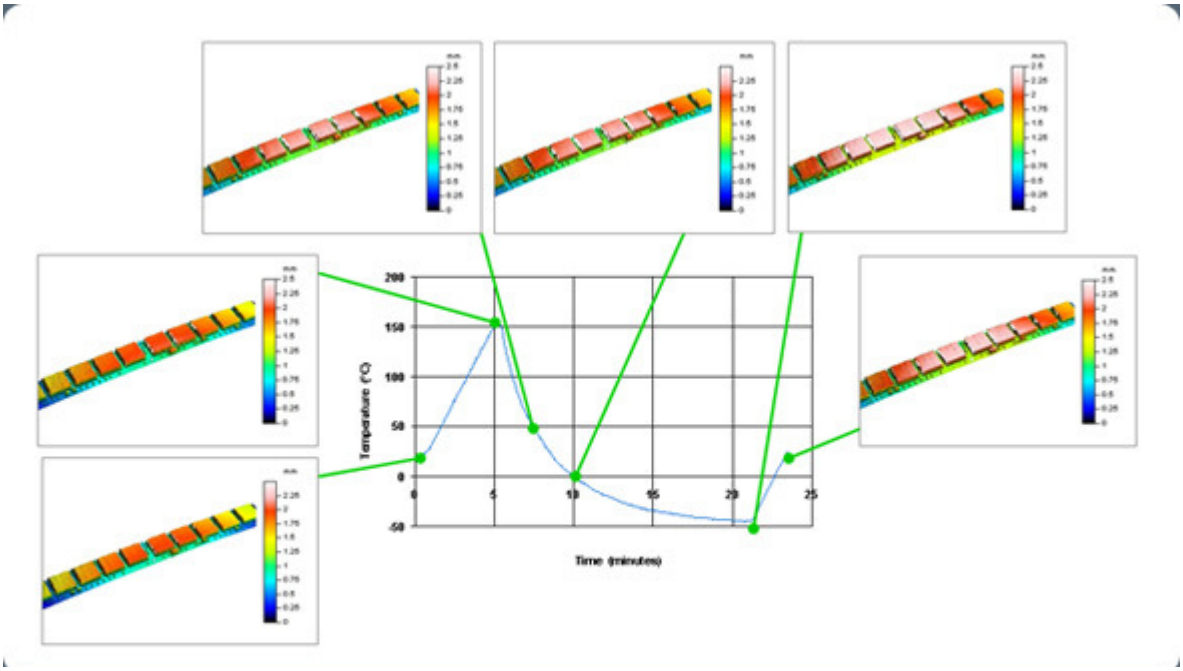
- ***Modular system design for high resolution measurements on virtually any given assembly configuration***
- ***Full 3D topography rendering, even in presence of vertical steps, holes, or very fine contact structures***
- ***Fast and homogeneous heating and cooling even on large samples***
- ***Powerful topography analysis software for visualization of even small deformations***

With the possibility to analyze the assembly behavior under realistic operation conditions in your laboratory, the reliability expectations of new products might be assessed in a very early design phase. It is now possible e.g. to check the interaction of a given component with several alternative PCB materials, to analyze the deformation characteristics of a component for different mould compounds, or to optimize the curing and reflow conditions for failure free soldering of a MEMS sensor, resulting in :

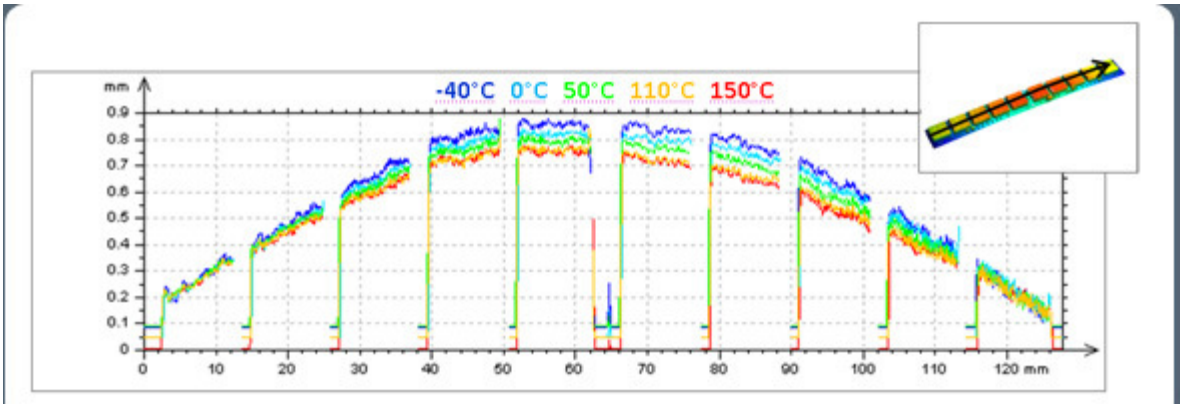
- ***Failure mode recognition before physical failures occur***
- ***Shorter time-to-market through faster failure risk assessment***
- ***Advancement toward "zero failure rate" under customer defined operating conditions***

The illustration below shows a deformation analysis as applicable for rough operating conditions, such as those typical for automotive, railway, or aerospace electronics :
The assembly (a 130×50×3mm PCB equipped with various components) undergoes successive temperature cycles between -40°C and +150°C.

The 3D topography of the central 125×14mm stripe is shown for various temperatures. Note that the total height amplitude of the assembly is about 2.5mm, and that all components are represented in a way that allows deducing their vertical height, if necessary.



Details of the warpage vs. temperature characteristics can be obtained by extracting a 2D profile along the central line of the components, and displaying these profiles in one single image as done in the following Figure. For better detail view the profiles are cut off shortly under the lowest point of the component surface. The PCB level is another 1.5mm below the lowest point represented in these profiles. Note that in this representation, deformations in the sub-mm range become visible. It can be deduced that the total warpage amplitude along the central line of the components varies from 650µm at 150°C to more than 770µm at -40°C.



Both the strong overall warpage at all given temperatures as well as the important warpage variation with the temperature between -40°C and +150°C will certainly intrigue the reliability design engineer. The detailed analysis of the root causes will allow to decrease the overall warpage, and to reduce its temperature dependence, in order to finally enhance the in-field reliability of the assembly.